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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY.DOCKET NO.	CONFIRMATION NO.
09/961,036	09/21/2001	Madhav Datta	884.523US1	4661

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EXAMINER
KIELIN, ERIK J

ART UNIT	PAPER NUMBER
2813	

DATE MAILED: 04/08/2003

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/961,036	DATTA ET AL.	
	Examiner	Art Unit	
	Erik Kielin	2813	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *10 February 2003* .

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *17-19,21,23 and 25* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *17-19,21,23 and 25* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *21 September 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

This action responds to the Amendment filed 10 February 2003.

Drawings

1. The drawings are objected to under 37 CFR 1.83(a). The drawings must show every feature of the invention specified in the claims. Therefore, the limitations of claim 18 --more specifically, the connection of the copper pad contacting a metallization in a range from M1 to M6-- must be shown or the feature(s) canceled from the claim(s). No new matter should be entered.

A proposed drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

This objection is repeated from the Office action filed 1 November 2002.

Specification

The specification is objected to as failing to provide proper antecedent basis for the claimed subject matter. See 37 CFR 1.75(d)(1) and MPEP § 608.01(o). Correction of the following is required: the limitations of claim 18 do not appear in the specification.

This objection is repeated from the Office action filed 1 November 2002.

Claim Rejections - 35 USC § 103

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

3. Claims 17, 19, 21, 23, and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,376,584 (**Agarwala** et al.) in view of US 6,348,730 B1 (**Yi** et al.).

Agarwala discloses a process of forming a ball limiting metallurgy (BLM) comprising,

forming a metallization (layer shown beneath that layer labeled "**20**" in Fig. 3, but not labeled, to which the BLM layers **22**, **24**, and **26** electrically connect);

forming phased metal layer **24** using physical vapor deposition, which comprises two metals including a first metal of Cr, Ti, Zr, Mo, Ta or any other metal or alloy which will adhere to the surface of the metallization and a second metal including Cu, Co, Ni, Pt, and Pd (paragraph bridging cols. 3-4); and

forming a conductive bump **28**, Figs. 4-6 above the phased metal layer **24**.

Agarwala does not indicate the nature of a phased metal layer, or more specifically that the phased metal layer includes a first and third layers of substantially the same metal and the second and fourth metals are of substantially the same metal.

Yi discloses a BLM and method of making, having a phased metal layer **53** (Figs. 8-9, plurality of **151** and **155**) formed by physical vapor deposition (e.g. sputtering; col. 3, lines 39-44), wherein the first and third metals are the same (Cr in one example) and second and fourth metal layers are the same (Cu in one example). (See also col. 3, lines 7-14; col. 4, lines 32-49.)

It would have been obvious for one of ordinary skill in the art, at the time of the invention, to form the phased metal layer of **Agarwala** using the method of **Yi** wherein the metal composition alternates between the different metals, in order to achieve the benefits indicated in **Yi**, such as achieving the desired thickness of the metal layers (col. 2, lines 59-63); and speeding up the process and reducing the cost of making the metal layers (col. 2, lines 64-67).

4. Claim 18 is rejected under 35 U.S.C. 103(a) as being unpatentable over **Agarwala** in view of **Yi** as applied to claim 17 above, and further in view of Microelectronics Packaging Handbook, Semiconductor Packaging, Part II, 2nd edition, Tummala, et al. eds., Kluwer Academic Publishers: Boston, 1997, pp. 132-139 (**Handbook**, hereafter).

The prior art of **Agarwala** in view of **Yi**, as explained above, discloses each of the claimed features except for indicating that the metallization contains one of M1 to M6 connected to a copper bonding pad metallization.

The **Handbook** teaches that it is notoriously well known (1) for the bonding pad to be copper (p. 137, last paragraph, and Fig. 8-6 on p. 138), as well as (2) for the bond pad to attach to one of the metallization layers (the third metallization layer as shown in Fig. 8-2, on p. 133). It would have been obvious for one of ordinary skill in the art, at the time of the invention to ensure that the BLM of **Agarwala** connects to a copper bond pad because copper bond pads are notoriously well known in the art, as taught in the **Handbook**, and for the bond pad to connect to one of the metallization layers, in order to make an electrical connection to the devices in the semiconductor chip, as is essential for providing power, signal input/out, etcetera, as taught by the **Handbook**.

Response to Arguments

5. Applicant's arguments filed 10 February 2003 have been fully considered but they are not persuasive.

Regarding Applicant's response to the drawing objections on p. 1. Applicant "asserts that the metal-one (M1) to M6, whatever is present in a substrate, is conventional." And according to 37 CFR 1.83(a) conventional features, not required for a proper understanding of the invention, should be illustrated using a graphical symbol. Applicant continues, "That the metallization makes connection to a given wiring layer such as M1 to M6, is not essential for a proper understanding of the invention."

While Examiner duly notes these statements, and agrees that the *uppermost* metal layer M6, as noted in the instant specification, will be in contact with the copper metallization pad, Examiner respectfully disagrees that it is conventional for the contact pad to be in contact with a metallization layer below (i.e. M1 through M5) the uppermost metallization layer. Moreover, and as noted above, given that the specification lacks antecedent basis altogether for the limitation of claim 18, that the copper metallization pad is in contact with *any* of the metal layers M1 through M5, a showing of how such could be accomplished is, in fact, essential for the proper understanding, since it is not conventional to somehow form a contact pad *below* other metal layers.

In this regard, Applicant further asserts, as stated in the penultimate paragraph on p. 5 and the paragraph bridging pages 5 and 6, that Tummala shows that connection to any of metal layers M1 to M6 is conventional and shown in Tummala. This is incorrect. Tummala, rather, shows the contact pad connected to the *uppermost* metal layer only --not to any of the metal layers *below* it.

Accordingly, Tummala fully supports Examiner's position that it is not, in fact, conventional to form the contact pad to metal layers *below* the upper most metal layer. For this reason, a drawing is necessary to show the copper connection pad in contact with M1, M2, M3, M4, M5, each of which is below M6, because this is not easily understood and is not conventional.

For this reason, the drawing objection is maintained.

Regarding Applicant's response to the objection to the specification as failing to have an antecedent basis for the limitations in claim 18. Applicant has addressed the limitations in claim 17 --not claim 18. Accordingly, the objection is maintained.

Regarding Applicant's response to the rejection of claims 17, 19, 21, 23, and 25 under 35 USC 103(a) over Agarwala in view of Yi. Applicant argues at p. 4,

> "Initially, the Office Action admits that Agarwala '584 does not indicate that the metal layers include 'first and third layers of substantially the same metal and the second and fourth metals of substantially the same metal.' (Office Action at page 7). The Office Action looks to Yi '730 to remedy this deficiency."

First it is noted that this excerpt is taken out of context and does not accurately reflect Examiner's statements. The action, as repeated from above, states specifically,

> "Agarwala does not indicate the **nature of a phased metal layer**, or more specifically that the phased metal layer includes a first and third layers of substantially the same metal and the second and fourth metals are of substantially the same metal." (Emphasis added.)

Yi explains to one of ordinary skill specifically what is a "phased metal layer," such the one of ordinary skill would know how to apply the teachings of Agarwala, in general. Yi teaches that a phased metal layer is composed of alternating layers of two different metals and consequently

explains to one of ordinary skill what the phased metal layer of Agarwala is likely to look like and how it may be made.

Applicant continues,

> "Regarding the teaching of Yi, the Office Actions states at page 7, that 'the first and third metals are the same (Cr in one example) and second and fourth metal layers are the same (Cu in one example). (See also col. 3, lines 7-14; col. 4, lines 32-49.)' But these statements are not correct."

Applicant further elaborates on Applicant's interpretation of the Yi reference to p. 5. While this interpretation of Yi is duly noted, Examiner respectfully disagrees that the characterization and/or statements in the Office action regarding Yi are incorrect. The phased metal layer **53** of Yi clearly shows first, third, fifth, etc, metal layers (each designated as 151) to be made of the same metal and second, fourth, sixth, etc. metal layers (each designated as 155) to be made of the same metal. The order and layer contact is as instantly claimed. Although each layer (either 151 or 155) is shown to be composed of laminates, the laminates only determine the thickness of the layer (either 151 or 155) and are accordingly a only single layers of metal *of varying thickness* as Yi states at col. 4, lines 37-42,

> "The chrome layers 151 get thinner from the chrome layer 51 toward the copper layer 55, while the copper layers 155 get thicker from the chrome layer 51 toward the copper layer 55."

Note, by contrast, that the individual laminates with a given layer, 151 or 155, are not shown to change thickness. So Yi teaches that the laminates form a *single* metal layer *varying in overall thickness* based upon the number of laminates in the layer. For this reason, it is respectfully asserted that Yi does teach that the third metal layer is in direct contact with the second metal

layer and that the fourth metal layer is in direct contact with the third, etcetera, in any phased metal layer. Accordingly, Applicant's argument in this regard is not found persuasive.

Note moreover, that claim 17 only require (1) that the first metal layer be "over" the metallization, (2) that the second metal layer be "over" the first metal layer. While the third and fourth metal layers appear to be required to be formed in direct contact with the second and third metal layers, respectively, there exists no such requirement for the first and second metal layers. Moreover, the conductive bump is formed "above" the fourth metal layer --not in contact with it. Accordingly, Applicant appears to be arguing a limitation absent in Li which is not presently claimed. Note that although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Regarding Applicant's response to the rejection of claim 18 under 35 USC 103(a) over Agarwala in view of Yi and further in view of Microelectronics Packaging Handbook, Semiconductor Packaging, Part II, 2nd edition, Tummala. Applicant's arguments rely on the perceived deficiencies in Agarwala in view of Yi to teach the limitations of claim 17. Examiner incorporates the above arguments herein. No further argument is provided.

Conclusion

6. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO

MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 703-306-5980. The examiner can normally be reached on 9:00 - 19:30 on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Carl Whitehead, Jr., can be reached at 703-308-4940. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Erik Kielin
April 7, 2003